DECEMBER 4, 1959

GAS IN INDUSTRY

Supplement to the "GAS JOURNAL"

Vol. 2 No. 19

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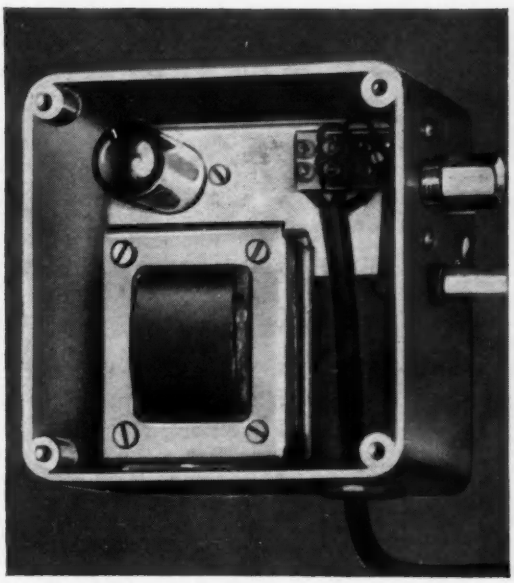

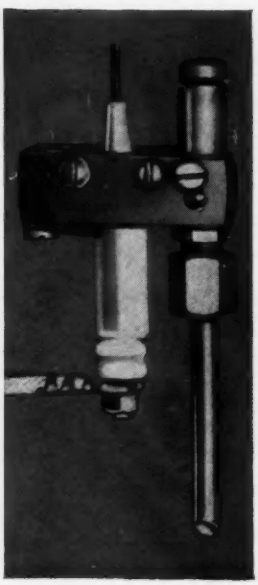

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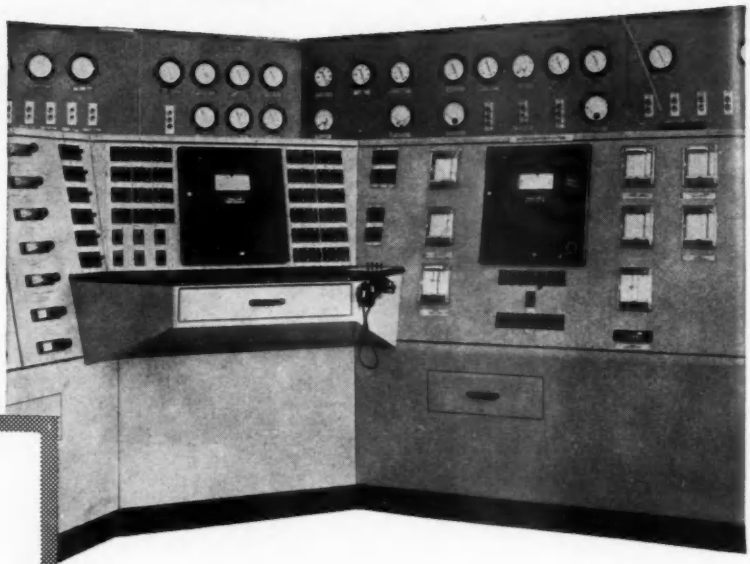

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GAS IN INDUSTRY

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FEATURES

BATCH TYPE FURNACES USED IN NEW AMERICAN HEAT TREATMENT PLANT

DIRECT HEATING OF LARGE INDUSTRIAL BUILDINGS
By F. S. Howard

PERFORMANCE TESTS ON DUTCH GAS-FIRED BAKING OVEN

RAPID DEGREASING OF MARINE ENGINE PARTS

ATTRACTIVE INCINERATOR SAVES FLOOR SPACE

DEEP FAT FRYERS AND FRYING RANGES
By 'GAStronome'

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Editorial

Gas for Factory Heating

THERE are in industry an increasing number of uses to which gas can be put, among which space heating in all is applications is of particular interest. To industrialists the heating of factories and office blocks is of great importance, since in both cases uncomfortable conditions, either too hot or too cold, can have an adverse effect on production. It is hardly necessary to point out that in the factory without proper heating, there will be an almost overwhelming temptation for the occupants to crowd round the available sources of heat on a cold morning instead of starting work, and even afterwards when a convenient opportunity offers itself. Proper heating and the maintenance of a proper degree of comfort are therefore of some importance to both employee and management.

We are publishing this month a paper by Mr. F. S. Howard on 'The Direct Heating of Large Industrial Buildings' which shows how different are the conditions in such buildings compared to those in the office block or domestic house. The problems facing the designers of the heating systems in each type of building differ fundamentally. The office block, divided as it is into a large number of comparatively small compartments, each with its own radiator or radiators, has a considerable heat capacity which needs to be heated over a number of hours before a level of comfort can be attained; but once attained, it is fairly easy to maintain the desired temperature by a conventional central heating plant. In the large factory building or workshop, however, the conditions are quite different and variants of such a heating system would not be suitable, principally because unassisted convection from radiators would be too slow to be effective and also because of the low heat storage capacity of the building itself.

Mr. Howard describes two main methods of heating such buildings—warm air heating and overhead, gas-fired radiant heating. In the former system air is circulated through a type of heat exchanger and blown into the building, thus increasing the air circulation as a whole. Such heaters developed in America may be fired by gas and can be placed either on the factory floor or in the roof space. If in the latter position, the warmed air may be ducted to various parts of the building. Like all forms of air conditioning, such a system needs the building to be effectively sealed to prevent cold draughts blowing in from loading bays, so Mr. Howard recommends overhead, gas-fired radiant heating. If this is carefully sited, such a system can heat a large factory building most effectively. By carefully locating the individual radiators, heat can be directed to where it is needed and such obstructions as overhead cranes can be allowed for. The sudden cooling by opening doors may cause a temporary drop in temperature but this is soon counteracted and comfortable conditions are quickly restored.

From the description in the paper of an installation of thermostatically controlled heaters, we gather that this form of heating is very popular with the men on the factory floor and since it shows a distinctly lower cost for the heating, per square foot, of the workshop concerned, the management will also be satisfied with the results obtained.

A cooler tube stack about to be lowered into the smaller tank. The Marinite covers have been removed and are against the side wall while those of the larger tank are in position.

Degreasing marine engine parts must be rapid

THE few days spent in discharging and taking on new cargo give little rest to the ship's engineer, for in these short periods overhauls and repairs which could not be undertaken during the voyage must be completed. He relies very largely upon the engineering facilities available on land, and those at London's docks are among the most comprehensive in the world.

Before work is started on a repair it is usual to remove the accumulated oil and grime by degreasing, and at the repair workshops of R. & H. Green & Silley Weir Ltd., this is done by immersing the parts to be cleaned in a heated detergent solution. To cope with the larger marine engine parts a new tank 9 ft. long 5 ft. wide and 7 ft. deep has recently been installed alongside a smaller tank, of about half the capacity, which has been in use for about two years. The firm's experience with immersion tubes on this tank convinced them that this system, giving efficient and rapid heating, should be adopted for the new installation.

As in the previous instance, the Industrial Section of the North Thames Gas Board offered advice and eventually supplied the burner equipment which was fitted by the firm's own engineering staff.

Five 6-in. Selas tube firing burners give a maximum gas rate of 2,500 cu.ft. per hour, and during a test run 900 gal. of water, about 50% of the normal capacity, was heated from 75°F. to 145°F. in three quarters of an hour.

Funnels on the discharge ends of the immersion tubes improve efficiency by reducing the excess air entrained at the burners and slowing down the passage of the hot gases through the tubes. An Aric indicating thermostat automatically controls the temperature of the solution to ensure economy in operation.

In both cases the sides of the tanks are lagged and 1-in. thick removable Marinite covers further reduce heat losses from the liquid surface during the periods when the tanks are not in use.

Compressed air agitation ensures constant movement of the solution through and around the parts to be degreased.

A view into the burner pit of the new degreasing tank showing the five Selas tube firing gas burners. The relay valve on the gas supply is controlled by the Aric indicating thermostat which is seen next to the dial type thermometer used for the smaller tank.

HEATING THE FUSING FURNACE

THE development of the Incandescent Jetube radiant heating element for use in vitreous enamel fusing furnaces was referred to in a paper to the Scottish Section of the Institute of Vitreous Enamellers in February, 1958. This brief mention aroused considerable interest, and since that time two prototype furnaces using specially designed Jetubes have been built and tested by the development division of the Incandescent Heat Co. Ltd.

Now the first batch furnace using this system has been built for an important vitreous enamelling works, and will be in service in a few weeks. A continuous split crown furnace, also heated by Jetubes, has just been commissioned at the works of Smart and Brown Limited, Spennymoor, Co. Durham.

The Jetube radiant element (which may be gas- or oil-fired) gives flexibility of operation, and allows the use of a highly insulated furnace structure with low thermal storage. Consequently fuel consumption is low, and output is greatly increased. Jetubes have already gained wide acceptance in industry as heating elements in batch and continuous furnaces for carburising, hardening, annealing and stress-relieving.

A Dravo air heater installed in the roof space for heating a new stores warehouse in Liverpool. Note the ducting for transferring the warmed air to different parts of the building.

DIRECT HEATING

of large industrial buildings

AFTER nationalisation in 1949 the North Western Gas Board reorganised the industrial departments throughout its area and this was finally completed about 1950. The Board has encouraged the industrial gas engineer by means of a special central heating tariff to secure as large a proportion of the heating load in new and existing factories which industrial expansion and competition from other fuels would allow.

Running costs

The situation with regard to fuel has now completely changed. Gas as a refined fuel, is relatively expensive when compared with oil and solid fuel, and a very close control over running costs is essential to help to offset this disadvantage.

The balance and trend of space heating in large industrial buildings has favoured the installation of unit heaters, and this has been particularly the case in extensions to existing factories. The reason for this has been

By F. S. HOWARD

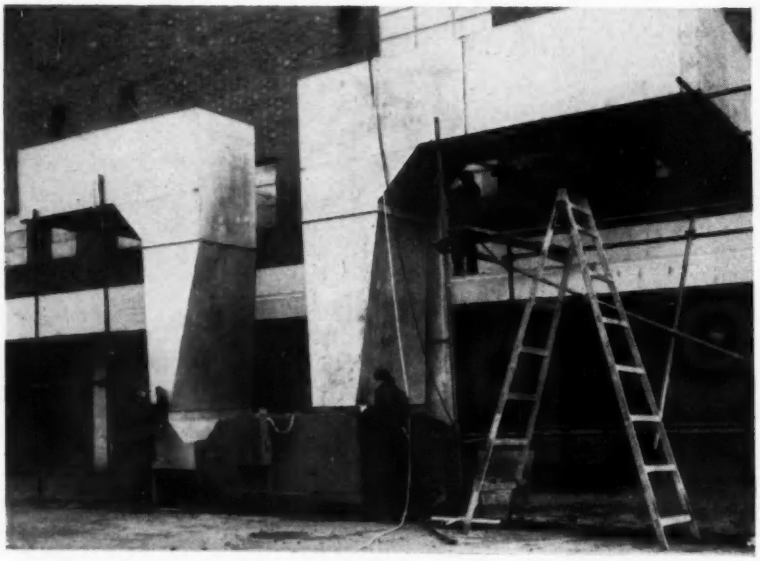
a combination of circumstances, namely:

1. High capital costs of central plant schemes in relation to unit heater schemes.
2. Shortage of money for capital investment (necessity to invest what money is available in production plant equipment).
3. Flexibility of unit heater schemes with their direct heating and low capital cost.
4. Extremely long delivery periods for central boiler plant.
5. Existing boiler plant and mains already overloaded to heat factory extensions.

Large factory buildings have followed a general pattern of construction and usually have in common such features as light asbestos and glass roofs, thin brick or insulated asbestos or metal walls, and concrete floors. Worse features than these could scarcely be imagined by a heating engineer having a nightmare.

Decreased appeal

Until a few years ago gas unit heating in large buildings had attractions for industrial firms, both with air heating and radiant heating installa-



An air heating unit being installed on its side after being specially adapted for heating the Harringay Arena.

tions. With the increasing attraction of oil and the tremendous publicity and vigorous sales campaign of the oil companies, the appeal of gas to industrial firms for unit heating, especially in the air heating field, has had to be vigorously defended.

Higher capital costs

An increasing amount of central plant is now being installed and this plant is mostly oil fired. Many more schemes of oil fired unit air heaters are also being installed even though the capital cost of the oil fired equipment is higher. Radiant heating, therefore, remains our strongest weapon in securing gas loads in the large space heating field. The more investigation carried out into this method of heating, the greater its advantages appear to be, and these advantages have been improved upon in the last few years by the evolution of the Schwank high level radiant panel now marketed by a number of firms in this country.

Office block example

Heating systems fall generally into two main categories: (*a*) Direct systems, in which the fuel or energy purchased is consumed in the rooms or workshops to be heated. (*b*) Indirect systems, in which the fuel or energy is consumed at some centralised point outside the rooms or workshops to be heated.

The main system of heating under consideration will be that of direct heating, since this system most favours the utilisation of gas, but at the same time it will serve as a comparison to consider at least the general requirements of an indirect system. But before considering the factors that affect the choice of a heating scheme in industrial buildings, it would serve to illustrate a point by considering the heating of an office block.

From a paper to the Manchester District Junior Association of Gas Engineers

In large blocks of offices the technique of heating is somewhat different from that employed in factory buildings. In office blocks the mass of structure to be heated from cold is enormous and therefore the heating engineer utilises the heat storage capacity of the building in the design of his heating scheme. The weight to volume ratio for the usual type of office block is extremely high and the time taken to heat a building from cold may vary from 30 to 48 hours before approaching comfort conditions within the building. Once this condition is reached, however, this large heat reservoir is extremely useful in combating the usually fickle British weather.

In factory buildings the weight to volume ratio is extremely low and therefore in a well-designed scheme little or no attempt is made to heat the building structure. Therefore air heating, and especially radiant heating, because of their quick heating-up characteristics and flexibility are admirably suited to this type of building.

The size of a building has a considerable influence on the choice of scheme. In very large buildings that are new, and are of the order of 500,000 sq. ft. or more in floor area, and where a process load is required, it would probably be the choice of the management to instal a central boiler plant, and in such a case gas would not be competitive. A competitive case, however, for a gas-fired direct system could be made for a building or factory in which there was no process load required. This would be even more attractive if a contract tariff were to be already available for an existing gas load.

Choice of system

To consider any building bigger than this particular example of 500,000 sq. ft. would, to say the least, be a little ambitious, and this arbitrary figure will serve as a maximum case for consideration.

It can be established therefore that the following may all affect the choice of a heating system: (1) The size of building, (2) whether new or an existing building, (3) the process load require (or in existence), (4) the design of the structure, (5) occupation time, (6) the space for the boiler house, etc., (7) and the capital available.

The considerations are numerous and it would be difficult indeed to list them all. We are at least aware of them, but at present we need only to consider the running costs and capital costs. These costs are the most important considerations; the other aspects are generally local, and only add complications to a situation that

TABLE 1

	Capital cost	Running cost per hour	Heat input mill. B.t.u.
1. Steam boiler and ancillary plant, etc. (boiler house extra). Fuel oil	£22,000	26s. 0d.	5.0
Labour and other running costs ..		4s. 6d.	
Total		30s. 6d.	
2. Direct warm air unit heaters (18 units). Oil	£13,800	33s. 0d.	6.4
3. Direct warm air units (4 units). Oil.. ..	£9,000	31s. 0d.	6.0
4. Direct radiant heating. Gas	£7,950	31s. 0d.	4.5

TABLE 2

Type of heating	Heat input mill B.t.u. per hour	Fuel Cons. mill B.t.u. per hour
No. 3 Air heating (Oil)	6.0	7.5
No. 4 Radiant heating (Gas)	4,05	4.5
Balance		3.0

may already severely test the author's capacity.

It may be of interest to quote some estimates obtained for a very lightly clad building with a floor area of 53,000 sq. ft. (Table 1).

The radiant heating scheme is therefore favourably placed, and this serves to indicate that if the above is a true example of the existing situation in heating a typical factory or works, then radiant heating is the choice for the industrial gas engineer to exploit to the utmost.

A comparison of scheme 2 with scheme 3 shows the savings which can be made by installing a small number of large heater units compared with a large number of small heaters.

Thermal efficiency

Radiant heating is a true direct form of heating inasmuch as the products of combustion are released into the workshop, whereas the recommended air heating units all pass products of combustion through flues to the outside atmosphere.

The loss of heat up the flue in the air heater can only place it at an overall disadvantage when compared with the gas radiant scheme of approximately 10%, since there is the latent heat loss to be set against the direct gas radiant heaters. That is to say, radiant heating is 90% thermally efficient as against the claimed 80% of the air heater. However, another cumulative advantage for radiant heating is that the heat input is less than that required for air heating. This is because comfort conditions can be obtained with a 5°F. lower air temperature than that required for an air heating scheme. The height allowance in the heat loss calculations is smaller, since there is a small floor to roof temperature difference.

The thermal gain, therefore, when comparing the radiant scheme No. 4 with scheme No. 3 is illustrated in Table 2.

Theoretically therefore to heat the same premises to the same degree of comfort, the air heating scheme requires over 60% more heat than the radiant heating scheme. The balance is therefore very favourable indeed until the relative cost of fuels is examined. The picture then once again changes. The radiant scheme is very attractive at 13.5d. per therm but unattractive at 18d. per therm.

Other considerations that can influence the choice in favour of a radiant scheme are those mainly of convenience, such as no valuable floor space required, more rapid heating up and therefore quicker establishment of comfort conditions, more even heating if thermostatically controlled, and better flexibility in heating small localised areas when the whole building is not in use.

It would appear that when air heating is a specified choice of the customer and radiant heating is not considered, it is largely a question of direct comparison of gas and oil fuel prices, together with some small adjustment for more frequent maintenance and a higher offset of capital charges with the oil fired scheme.

The achievement of comfort conditions in large industrial buildings can be obtained in different ways. In the type and size of building considered it is extremely difficult to control the ventilation rate, and even in a similar building that is insulated, there are often large doors for loading and unloading which are frequently opened with a resulting drop in temperature. Air heating can, therefore, be an expensive form of heating in any shape or form, and it appears desirable for the gas engineer to limit this form of heating to the specialised cases of heating stores, etc., where air movement is necessary. One should therefore encourage industrial firms whenever possible into the wider and more economical use of radiant heating.

Psychological approach

It is not an easy matter to persuade someone who doubts the effect of radiant heating in establishing suitable comfort conditions, and this often requires a tactful psychological approach. The development of a suitable practical instrument for the easy measurement of comfort conditions would go a long way towards helping to solve this small but nevertheless important facet of putting forward a convincing case for radiant heating to prospective customers.

It is probable that we can attribute the advent of air heating in this country in its present projection form of application in large industrial buildings, to American influence.

One type of heater on the market is an oil-fired or, alternatively, gas-fired unit and is a similar model to that made in the United States.

An air heating unit placed in the roof space of a large industrial building. All cold air passing to the heater is brought from outside the building by the large duct.

This is a floor standing unit which is extremely adaptable and can be mounted on its side, or upside down. This is frequently required when floor space is at a premium, and the heater has to be mounted in the roof trusses.

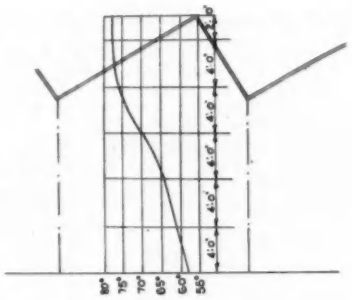
The heater illustrated is fitted with two air supply fans and one exhaust fan on a common shaft driven by an electric motor, air for combustion being taken from one of the main supply fans which draws in the recirculation air from the room at three sides and passes it over the combustion chamber. Finally it discharges the warm air through adjustable louvred outlet nozzles. These nozzles can be rotated for the directional projection of the warm air, which is at a temperature of 140°F.

Counterflow design

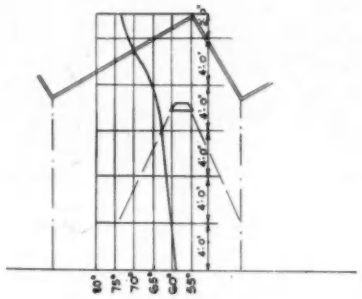
The combustion chamber is constructed of stainless steel welded sheets, the products of combustion reversing their direction of flow after leaving the burner and passing back above the flame and then down and through two staggered banks of economiser tubes equipped with inside swirlers. The coolest gas meets the coolest air and the heat exchange therefore follows a counterflow design.

The outside casing is of a double skin with an enclosed air space to give a low outside surface temperature. Careful selection of a flue terminal is not really necessary as the products of combustion are under a small fan pressure.

The range of sizes produced in this type of unit have heat outputs that vary from 400,000 to 1.5 mill. B.t.u. per hour. The principle of operation of the free floor standing model is to provide a projected stream of warm air across the roof space at a height of 10 to 14 ft., the return air being passed back at floor level for recirculation. The warm air being projected across the roof does not readily rise as it is replacing the colder air being returned at floor level. The heaters are rated at approximately 11,000 cu.ft. per minute per mill. B.t.u. output.



(a) With air heaters.



(b) With radiant heaters.
Suggested vertical temperature gradients in a north light factory.

The units themselves are completely automatic with automatic ignition and programme sequence control for air purging the combustion chamber, operating gas pilot supply, main burner, flame failure, and thermostatic control of air leaving temperature, room temperature, overheat control and a time clock for pre-selective times of operation.

There have been a number of these units installed in the Liverpool area recently; one firm has two installations, one for heating a large warehouse, the other for heating a production workshop. Another company's installation for heating a goods store was completed about four months ago in the works of a gas appliance manufacturer in the Prescot area.

Heating insulation

The Liverpool company's warehouse heating installation consists of two 1-mill. B.t.u. output units mounted in the roof trusses. It has now completed one heating season and some considerable trouble has been experienced mainly due to bad duct outlet design. This was installed by a reputable heating engineer who unfortunately had not had much installation experience with this type of heating and ductwork.

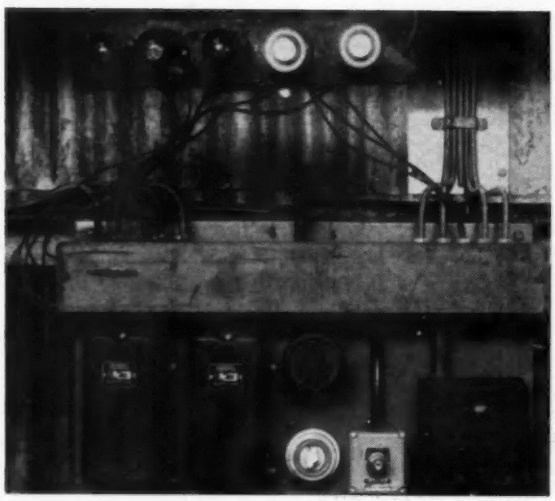
Although ducting in these systems may provide a technical advantage in better distribution at suitable strategic positions, it is not good economics to invest in considerable lengths of ducting which only gives a slight increase of comfort conditions in the working area or space used. The manufacturers would probably agree with this view.

The cause for the complaint was a low air velocity at the duct outlet, which consequently led to an extremely high floor to roof temperature gradient (between 60°F. and 100°.).

Running costs

This firm's first installation, however, of two floor standing heaters in the production shop, with outputs of 1 mill. B.t.u. per hour each, has been very successful, and the company has decided to use this form of heating in their new production workshop extensions, which are at present under construction. Unfortunately, the recent increase in the price of gas has influenced the company to convert these units to oil firing and this is a very unhappy outcome of all the initial work involved in obtaining the original acceptance of the scheme. The reason for this change from gas to oil is not so much due to the price increase as to the extremely high running costs in the warehouse heating installation. There were two main reasons for this, one of which to some extent has already been mentioned. They are:—

1. The unsuitability of the air heating scheme in the warehouse, which was the customer's own decision and



The main switch assembly for a thermostatically controlled radiant heating installation, including the lamp unit for testing.

which was based mainly on the success of the production shop scheme.

2. The stores has an integral loading bay and this has obviously contributed in a large measure to the high running cost by the constant opening of the large loading bay doors.

In each of the installations carried out in our area, thermostatic control is by means of individual thermostats, each controlling its own heater unit. The variation of temperature throughout the floor area at about 4 ft. to 5 ft. from the floor is negligible, being of the order of 3° to 4°F.

Gas radiant heating is not a new approach to the heating of large buildings, and many such projects were installed before the last war.

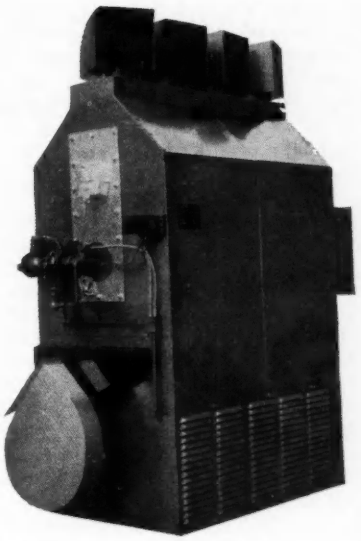
Correct positioning

A popular type of heater used in many of these installations is a wall mounted heater and is often referred to by customers as 'a gas fire on the wall.' It is very effective, and is usually fixed at a height of approximately 10 ft. from the floor. The main disadvantage of this type of heater is that it can be difficult to locate correctly in relation to the working area. If not correctly positioned, they can give rise to overheating of the uppermost part of the body, with the subsequent discomfort of a hot head and cold feet. They are not easily positioned in very large buildings because of the absence of suitable walls and it is both impracticable and uneconomical to hang them at distances of 15 to 20 ft. below the roof trusses.

A low pressure surface combustion burner, generally known as the Schwank burner, has become available as a horizontal unit in the last five years or so. This type of unit has now been accepted as the one most suitable for large buildings and has largely superseded the use of wall mounted heaters. This type of horizontal heater, together with a more recent neat flame burner model are admirably suited to this form of heating, giving an even distribution of radiant heat over large floor areas, and can be mounted above the crane tracks that often occur in large buildings.

Filament ignition

The fitting of permanent gas pilots is rapidly dying out because of their high running cost, so all the horizontal panel heaters are now available with ignition and flame failure control devices. Ignition by a low voltage permanent filament ignition unit manufactured by the Horstmann Gear Co. Ltd. is popular, a safety feature of which ensures that should the gas supply be interrupted and re-established, the heater will be re-ignited. In an electrical failure the magnetic valve closes and the gas is shut off automatically.



The Dravo air heater fired by gas which can be installed either standing on the factory floor or in the roof space.

Trouble-free service

A number of installations have been installed in the Liverpool area during the last couple of years in which both types of ignition units have been employed. The more expensive Schwank type igniter and flame failure unit has given some trouble and in one installation caused considerable embarrassment, but since the permanent filament type of igniter has only recently become available, we have as yet had insufficient district experience to comment upon its performance. One installation with this type of ignition unit has given trouble-free service for three months and it would appear to be an excellent igniter unit at a reasonable cost. The manufacturers recommend that it should be serviced once a year when the filament should also be replaced.

The Board has recently completed a radiant heating scheme for Frederick Braby & Co. Ltd., engineers and steel drum manufacturers, in which the units used have permanent filament igniters. It was completed in early February of this year and will be of interest since it incorporates thermostatic control of a somewhat unique design in such installations. The main reason why it was incorporated was to reduce running costs, and all competitive tenders for various air heating schemes had thermostatic control since the customer was not interested in any scheme without it.

In 1956 the works engineer asked for a quotation for heating the tank shop, which was at that time being heated by a number of large coke stoves. The management considered this form of heating to be very unsatisfactory, since it was bad for production, the men standing around the stoves trying to get warm and consequently neglecting their work.

Estimate accepted

An estimate was submitted and discussed with the works engineer, who some 12 months later decided to heat a small tank test shop, considered as bad a building as he could find in the works.

After a reasonably severe test and a close check on running costs, this small, manually controlled, pilot scheme was accepted as successful, with some reservations by the management, but wholly so by the employees.

The Board of Directors finally accepted the Board's revised estimate for the original tank shop scheme, which included a sum of £60 for thermostatic control equipment, in late September of 1958. With the assistance of Mr. R. K. Bell of the Rheostatic Co., Ltd., a system of thermostatic control was devised in accordance with ideas formed some months earlier. The conditions that had to be satisfied by the scheme were:

1. Control of comfort conditions within the building.
2. Reduction of radiant intensity by a number of small steps instead of the often used all, half or nothing system.
3. The method of control to be as sensitive as possible and so eliminate the aggravation of comfort conditions by under-heating and over-heating.

Local factors

The scheme consists essentially of breaking down the heat input of 4.5 mill. B.t.u. per hour into five stages and controlling each stage by outside thermostats; each stage has a temperature range of approximately 5 to 7°F., and five thermostats suitably positioned inside the building act as temperature or comfort limit thermostats.

The stages of heat input were mainly dictated by such local factors as the main working areas, the position and relation of outside and inside walls, and the siting of the loading bay, etc., but the most important consideration was to try and decrease in stages the levels of intensity proportionately over the whole floor area. The system evolved appears to be satisfactory in practice since the staff

have not yet made any complaints and so it has not been found necessary to alter the system as designed.

To establish satisfactory comfort conditions the heaters have to be switched on for 50 to 60 minutes before starting time in the morning. This time can be decreased if necessary by setting the electric clock to cancel the outside controlling thermostat for, say, the first 45 minutes and allowing all the heaters to be utilised in the initial heating-up period. The scheme has usually been operated with the automatic control system but five manual control panels have been incorporated so that any one, or number of heaters can be separately controlled, if desired.

In appendices 1, 2 and 3 included in the paper, operational data on this radiant heating scheme was given, together with corresponding information on a further radiant heating scheme designed for a similar building but manually controlled, and an air heating scheme.

Comparing the two radiant schemes, the actual running cost for the month of March, 1959, was .93d. per sq. ft. of floor area for the thermostatically controlled scheme, compared with 1.22d. per sq. ft. for the manually operated scheme, a saving of 25%. The cost of air heating of the warehouse for the same period worked out at 4.5d. per sq. ft. Although this may be an unfair example to take for reasons and conditions mentioned earlier when considering this particular installation it must be remembered that this was a new building, well insulated, and therefore a much superior structure to the other two buildings in which radiant heating had been installed.

It could be suggested that the saving of 25% by the thermostatically controlled scheme, over the manual scheme, could have been obtained by fitting ordinary simple inside limit thermostats; though possible, it is unlikely. The manually operated installation cannot give the performance of the controlled scheme, since it is not automatic in operation. Automatic control is an excellent selling feature.

INDUSTRIAL GAS DEVELOPMENT COMMITTEE*

Normalising duralumin aircraft components

AN Industrial Gas Development Committee report describes district tests on a 90/10 sodium nitrate/nitrite salt bath used to normalise duralumin aircraft components at 500°C. to A.I.D. standard at the Harper aircraft factory, Honiton Clyst, Exeter.

The salt bath was fabricated by C. E. Harper Aircraft Co. Ltd., to a design by the area industrial department. The bath is made from ¼-in. mild steel plate with the internal dimensions of 2 ft. 6 in. by 2 ft. 6 in. by 16 ft. long and having a maximum capacity of six tons of salt mixture. The normal working capacity is kept at about 4½ tons.

The bath is mounted in a ¼-in. mild steel plate outer casing lined with firebrick and insulating brickwork. It has the overall dimensions of 3 ft. 6 in. by 6 ft. 3 in. by 17 ft. 6 in. long, and the top is covered by four counter balanced mild steel lids.

Heating is provided by 24 burners, sited 12 at the bottom of each side. The burners are fitted with 1¼ in. long venturi Amal injectors. The products of combustion rise over a 2-ft. high guard wall and then pass down the side of the bath to the main flue duct measuring 1 ft. by 1 ft. 3 in. under the centre of the bath. This duct discharges into a 12-in. diameter chimney at each end of the bath. There are two 9-in. by 6-in. openings connecting the main chimneys with the top of the setting so as to provide sufficient flue pull when starting up from cold with only one or two burners operating. These openings are provided with dampers.

The 24 burners each have a rated capacity of 150 cu. ft. per hour with gas having a calorific value of 470 B.t.u. per cu.ft. The 2½-in. B.S.P. main gas supply is fitted with a quick action control valve, a Crawford governor set to give an outlet pressure of 3 in. w.g., and a Satchwell motorised valve. The latter valve is fitted with a 1½-in. B.S.P. bypass. An ignition torch is provided.

TEST RESULTS

Duration of test, 10 hours 20 minutes.
Total gas consumed, 32,410 cu.ft.
Calorific value, 470 B.t.u. per cu.ft.
Total heat input, 152.33 therms.
Total weight of salt, 10,660 lb.

Total heat required to raise salt to 950°F.
Atmospheric temperature, 68°F.
Average specific heat, 0.389 B.t.u. per lb.
Total heat required to raise temperature of salt, 36.57 therms.
Latent heat of fusion, 117 B.t.u. per lb.
Total latent heat of fusion, 12.47 therms.
Total heat required, 49.04 therms, 32.2% of heat input.

Flue Gas Losses.
Average atmospheric temperature, 68°F.
Average flue gas temperature, 701°F.
Average CO_2 content, 9.8% vol.
Excess air, 39.8%.
Flue gas loss, 24.6% of heat input.

Heat required to raise temperature of water vapour in air by 633°F.
The air contained 0.71 lb. H_2O/1,000 cu.ft.
Total air used, 164,000 cu.ft.
Total heat required, 0.74 therms, 0.5% of heat input.

Heat required to raise temperature of bath to 950°F.
Total weight of mild steel, 3,904 lb.
Specific heat, 0.116 B.t.u./per lb.
Total heat required, 3.99 therms, 2.6% of heat input.

Heat required to raise temperature of brickwork by 528°F.
Total weight, 16,176 lb.
Heat required, 20.45 therms, 13.4% of heat input.

Heat required to raise temperature of metal structure.
Heat required, 1.63 therms, 1.7% of heat input.

Heat balance.
1. Heat to melt salt, 32.2%.
2. Heat to structure, 17.7%.
3. Heat to flue gases, 24.6%.
4. Heat to water vapour, 0.5%.
5. Radiation, convection and other losses, 25.0%.

The temperature of the salt is maintained by the use of ten burners, the gas consumption being 1,156 cu.ft. per hour.

In accordance with common practice the temperature of the salt was raised to 510°C. (950°F.) during the heating-up period. The temperature was then allowed to stabilise on thermostat control throughout the night preparatory for A.I.D. approval on the following day.

* Reproduced from Reports nos. 679/58 of the Industrial Gas Development Committee of the Gas Council (Information supplied by the South Western Gas Board).

REPORT DESCRIBES PERFORMANCE TESTS ON DUTCH GAS-FIRED BAKING OVEN

AN Industrial Gas Development Committee report describes tests by the North Thames Gas Board on a Den Boer Econotype travelling oven at Warder's bakery, Ramsden Heath, Essex. The plant is manufactured by Bakovenbouw Voorheen H.P. Den Boer N.V., Dordrecht, Holland, and is distributed in this country by the Dutch Ovens Distributing Co. Ltd., Adams Place, Holloway, London, N.7.

Detailed tests were carried out over one night, while gas consumptions and bread production were observed over a full working week.

The oven is of the travelling type with a wire mesh conveyor 4 ft. 1 in. wide passing through a baking chamber 24 ft. 8 in. long. The overall external dimensions exclusive of flues and ancillary equipment are 32 ft. long, 6 ft. wide and 5 ft. 9 in. high.

The baking chamber is surrounded by an inner and outer steel casing between which granulated vermiculite insulation is inserted. Heat is applied above and below the conveyor by a number of ribbon type burners which fire on to tubular diffusing elements to provide radiant heat in addition to the natural convection from the products of combustion.

Sliding doors

There is a steaming zone at the inlet of the baking chamber which is isolated by flexible stainless steel curtains. Steam at this bakery is supplied from an oil fired boiler. Vertically sliding doors are fitted at each end of the baking zone to retain heat in the oven during heating up and standby periods.

The wire mesh conveyor has an average weight of 10 lb. 14 oz. per ft. length, and is arranged so that it extends horizontally 2 ft. 9 in. beyond the inlet and 3 ft. below the outlet of the baking chamber to facilitate loading and unloading. At the inlet end it is preheated to a temperature of approximately 205°F. by three burners, arranged 7 in. apart, situated under the working surface.

The conveyor speed may be controlled to give a period varying from six minutes to 60 minutes for travelling the length of the baking zone. On the return side, i.e., the underside, provision is made for maintaining the belt at even tension.

The high pressure burners are tubular in construction having a single perforated heat resisting steel insert for the flame port area. They are arranged transversely above and below the conveyor, each having its own control cock. There are 14 burners above the conveyor and 18 below with a further three at the inlet end to preheat the conveyor before it enters the baking chamber.

Each burner is ignited by an element which remains continually incandescent while the oven is in use.

Flue arrangements

There are four 6-in. diameter flues which carry products of combustion and steam from the oven. The first flue leads from the steaming zone and may be closed by a damper. The second and third flues lead from the baking chamber and the fourth is located at the discharge end. Each flue may be closed by a damper, and enters a common rectangular horizontal duct 4 in. by 15¼ in., to which is attached a single 15-in. diameter vertical flue. There is an eductor in this latter main flue to ensure effective removal of waste gases under all conditions. The eductor is operated by an independent fan with electric motor which the manufacturers supply as normal equipment with this type of oven.

A low-pressure cut off device is incorporated in the outlet of the compressor.

The gas compressor is of the multi-blade rotary type and anti-suction, recirculation and outlet pressure control devices are incorporated as integral parts.

The oven was lit approximately three-quarters of an hour before baking was due to commence. During the heating-up period all the burners were alight and the doors at each end of the baking chamber lowered to the level of the conveyor.

Baking was commenced when the oven had reached a temperature of approximately 450°F. Various types of bread are baked in one shift and during the period in which the oven was under observation, the following order was followed:

(1) Sandwich, (2) Hovis, (3) open tin, (4) farmhouse, (5) Procea, (6) bloomer, (7) Vienna, and (8) rolls. It appeared to be the custom in this particular establishment to use steam for all types, while baking temperatures were varied by manual control of the burners. On occasions, it was necessary to reduce the temperature of the oven quickly when changing over to a different type of bread, and this was achieved by passing a sand trough through on the conveyor.

Therms per sack

Attempts were made to determine the performance of the oven in terms of therms per sack. During the period that the oven was under observation, batches of two different types of bread, each sufficiently large to fill the oven completely, were baked. In each case the conveyor speed was such that the time taken for a loaf to travel through the oven was approximately 40 minutes. By the time the oven was completely filled with one type of bread, it was assumed that equilibrium had been reached and the output was determined from figures ob-

A SUMMARY OF THE COSTS RELATING TO THE WEEK'S PRODUCTION

Day	Production, sacks	Gas consp'tion, therms	Therms per sack	Retail value of production	Cost of gas	Cost of gas relative to value of goods
				£ s. d.	£ s. d.	%
Sunday/Monday ..	13·17	36	2·73	130 5 1½	2 12 3	2·01
Monday/Tuesday ..	13·07	33	2·52	129 7 6	2 7 11	1·85
Tuesday/Wednesday	12·47	31	2·49	123 5 6½	2 5 0	1·82
Wednesday/Thursday	12·87	32	2·49	127 19 8	2 6 6	1·82
Thursday/Friday ..	14·67	35	2·39	144 11 7	2 10 10	1·76
Friday/Saturday ..	21·45	51	2·38	209 4 4	3 14 1	1·77
Total	87·7	218	2·49	864 13 9	15 16 7	1·83

tained while the remainder of the batch was being loaded. Thus, from a knowledge of the output over the period in which the oven was completely filled with one particular type of bread, it is possible to calculate the output on an hourly basis.

Flue gas temperatures and the carbon dioxide content were measured at each of the four flues during each of the two test runs thus enabling flue losses to be calculated. Although the oven was working at a baking temperature of approximately 450°F. throughout the night, the external surface temperatures were estimated at approximately 10°F. above ambient. For this reason it was felt that a complete surface temperature survey was not necessary.

It was not possible to measure directly the fuel consumption of the oil fired steam boiler. The quantity of steam used was, however, determined by measuring the volume of water taken into the boiler from the feed tank. A boiler efficiency of 60% and the production of saturated steam has been assumed.

The gas rate during the heating-up period was found to be 600 cu.ft. per hour.

Tables are given in the report showing: Hourly outputs, fuel consumptions, heat into load, flue losses, heat into conveyor, surface losses, heat balance, and period production. Reproduced on the previous page is a summary of costs.

The report says that the following conclusions may be drawn from the results of the tests:

1. The gas consumptions for two test runs were 1.63 therms and 1.93 therms per sack respectively.
2. The oil consumptions for steam production for two test runs were equivalent to approximately 1.2 therms and 1.5 therms per sack respectively.
3. The average gas consumption for the whole week was 2.49 therms per sack.
4. The discrepancy between 1 and 3 suggests that the oven is not kept fully loaded, and that the weekly figures include heating up, and standby and cooling losses.
5. Surface losses from the oven are low, thus helping to keep the temperature of the bakery down to a comfortable level.
6. The carbon dioxide content of the flue gases is low. This could be improved by reducing the amount of excess air present.

Efficient incinerator for use where space saving and appearance are important

THE Refuzeta incinerator is a small, efficient and economical gas-fired appliance for the smokeless destruction of paper, rags, packing material, kitchen waste and other combustible matter which would be difficult to dispose of in smoke controlled areas other than by municipal collection. Apart from its direct application in the easy destruction of waste materials, many offices and other business premises will find it of value for the destruction of confidential documents.

The modest overall dimensions allow the Refuzeta to be accommodated in a confined space and the pleasing external appearance is in accordance with modern standards of domestic appliances. The top plate is vitreous enamelled and the sides and back stove enamelled in a contrasting colour.

Charging is by a hinged cover of generous size in the top plate and ashes fall into a removable pan in the base, to which access is gained by a hinged drop-down door at the front. The hearth is of cast iron, the centre section of which slides on guides so that it can either be shaken to sift ashes into the collecting pan below, or opened to dump larger lumps of ash and clinkers. Raking and poking to clear ashes with the attendant dust and dirt is therefore eliminated.

The main burner is electrically-controlled by one knob, and has automatic ignition. The knob is provided with a scale and pointer graduated from 0-6 hours and after charging the incinerator, the pointer is set to the

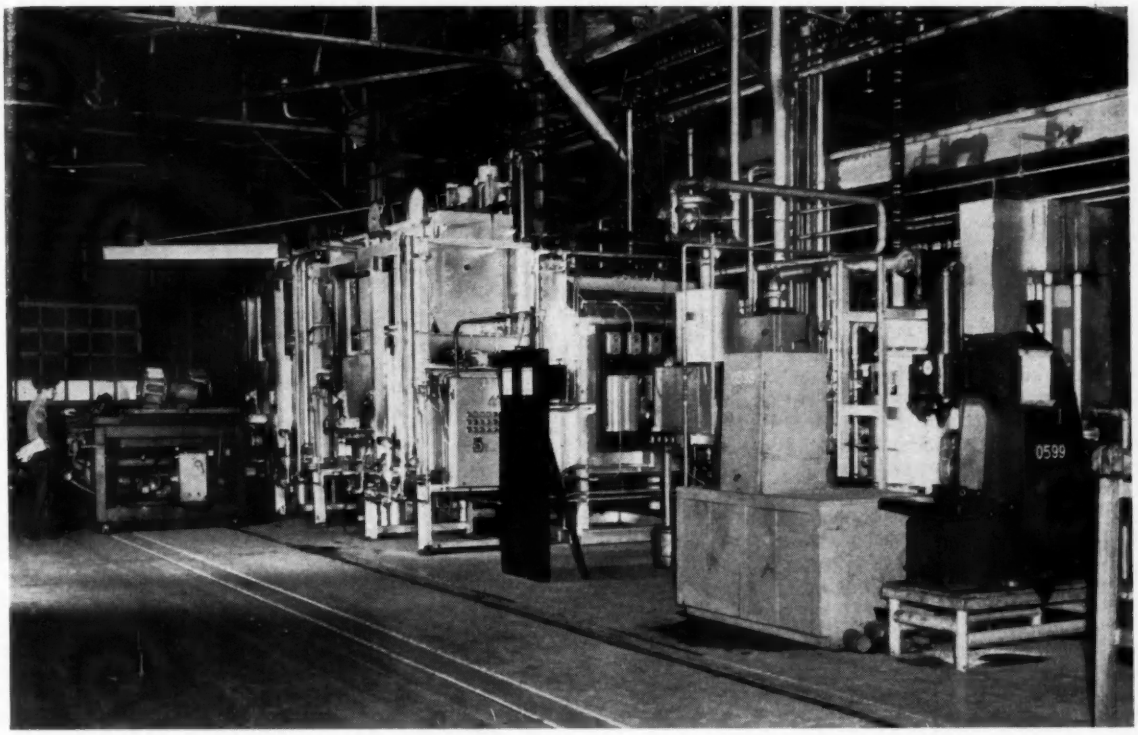
period which is known to be sufficient to dispose of the material. After the set period the burner shuts down without further attention, so that the gas cannot remain on indefinitely through neglect or inattention.

The igniter consists of an electric filament which lights a small pilot jet, which in turn lights the main burner, the gas to the latter being turned on automatically when the pilot jet is properly established. When the period set on the clock has expired, the pilot flame is extinguished as well as the main burner. The main burner is cast iron and is easily removed as a complete unit with the igniter for ease of maintenance. A gas governor is incorporated.

For an average charge, consisting mainly of waste paper, rags, etc., with a small amount of damp rubbish, such as peelings and kitchen waste, the period set on the timing device, i.e., the duration of the main burner, is approximately one hour.

Installation is simple. The incinerator is delivered completely assembled and it stands on a flat floor. All that is required therefore is provision of a suitable flue and connection of gas and electricity supplies. Specification is as follows:

Overall dimensions	23 in. wide by 23 in. back to front by 3 ft. 0½ in. high.
Size of charging chamber	15 in. wide by 11½ in. back to front by 16 in. high.
Effective volume of chamber	1.6 cu.ft.
Flue offtake	5 in. o.d. to suit 5 in. i.d. flue piping.
*Minimum height of flue	20 ft. from floor level.
Gas inlet size and pressure	½ in. B.S.P. female. Not less than 2½ in. w.g.
Gas consumption	85 cu.ft. per hour.
Gas consumption for one average charge	85 cu.ft. (approx.).
Electrical supply	230/250V, 50 cycles, single phase.
Electrical consumption	10/12 W.
Weight	330 lb.



Inspection station showing Brinell machine. The DX generator (next to the Brinell) provides 4,000 cu.ft. of gas to the atmosphere draw furnaces (left centre).

Batch-type gas furnaces used in new American heat treatment plant

BATCH - TYPE gas furnaces recently installed by the Harnischfeger Corporation, manufacturers of large overhead travelling cranes and hoists, excavators and truck cranes for mining, construction work and road-building, Milwaukee, Wisconsin, U.S.A., are providing an answer to the heat treatment of a variety of parts which called for flexibility in equipment.

Problems

At these works, certain parts such as large gears, rollers and shafts needed in most of the larger pieces of equipment, presented one problem, while the smaller parts found in other types of product presented another.

The larger parts, subject to extremely heavy shock loads, as well as static loads, require the utmost in hardness and toughness; the smaller parts, requiring no less in heat treating precision demand an easy and efficient method of handling for quantity production.

A large part of the Harnischfeger production consists of pinions, gears, rollers, shafts and pins ranging up to 6 in. in diameter. Alloy steels in the 4,100 and 4,300 series as well as cast steels of similar compositions are used. Normal hardening temperatures range from 1,500 to 1,600°F. Carburised parts produced from 8,600 and 4,300 series steels are similarly heated.

To handle this variety of parts a Super Allcase controlled-atmosphere hardening furnace, a spray washer, two controlled-atmosphere recirculating tempering furnaces and two atmosphere generators were installed. All of this equipment was built by Surface Combustion Corporation, Toledo, Ohio, for whom British Furnaces Ltd., Chesterfield, are the United Kingdom representatives.

The most common methods for case hardening are gas carburising and gas dry-cyaniding or carbonitriding. The choice of the method may be an economic decision. Dry-cyaniding is a relatively fast and easily controlled method for imparting thin, hard, wear-resistant surfaces to gears and many other parts. Low carbon, inexpensive steels can be case hardened to produce file hard surfaces with oil quenching, thus minimising distortion.

Advantages

Gas carburising is the most widely used and generally the most economical of case hardening processes. One of the chief advantages of the gas carburising process is the ease with which surface carbon concentration can be controlled by proper regulation of furnace atmospheres. Carbon control permits such definite economies as:

1. Direct quenching from carburising furnace without excessive retained austenite.
2. Maximum hardenability of case permitting use of relatively low alloy steels.
3. Reduction of cleaning costs of carburised work.
4. Increased furnace tray and alloy life due to minimum carbon corrosion.

Oil circulation

The Allcase furnace is of the enclosed quench type and completely automatic at the Harnischfeger plant. The furnace heating chamber, heated by suction type radiant tubes, has a work space of 30 in. wide, 48 in. long and 18 in. high. A roof fan circulates the atmosphere gas around the tubes and through the work load. Although primarily used for clean hardening, the 1,800°F. maximum temperature range makes it available for carburising purposes as well. The necessary enriching panel with automatic valves and flow meters is an integral part of the furnace.

Hot oil is circulated within the enclosed quench tank, and through coolers to maintain temperature control throughout quenching. Propeller agitators provide forced oil circulation around and through the load affording a better and more effective quench. A 1,200 cu.ft. per hour Surface RX gas generator supplies the necessary atmosphere for this furnace, as well as for a large radiant tube pit furnace installed near by and used for similar purposes.

Further to minimise operator attention, a Surface Autocarb automatic signalling dewpoint controller, monitors the RX gas generator and provides a constant analysis atmosphere at the hardening furnace. This combination supplies and controls a furnace atmosphere which permits a furnace production of an average of 460 lb. of net work per hour substantially free of surface decarburisation. The enclosed quench insures freedom from surface oxides or scale.

Tempering of the hardened parts is carried out in either of two identical tempering furnaces having an operating range of 400°F. to 1,250°F. The heating chambers are similar in size and design to the Allcase hardening furnace to accommodate the same tray size and load. Suction type radiant tubes are used for heating to permit the use of controlled atmosphere. Roof fans accelerate the heating rate (convection) and provide uniform heating of the work.

Minimum landings

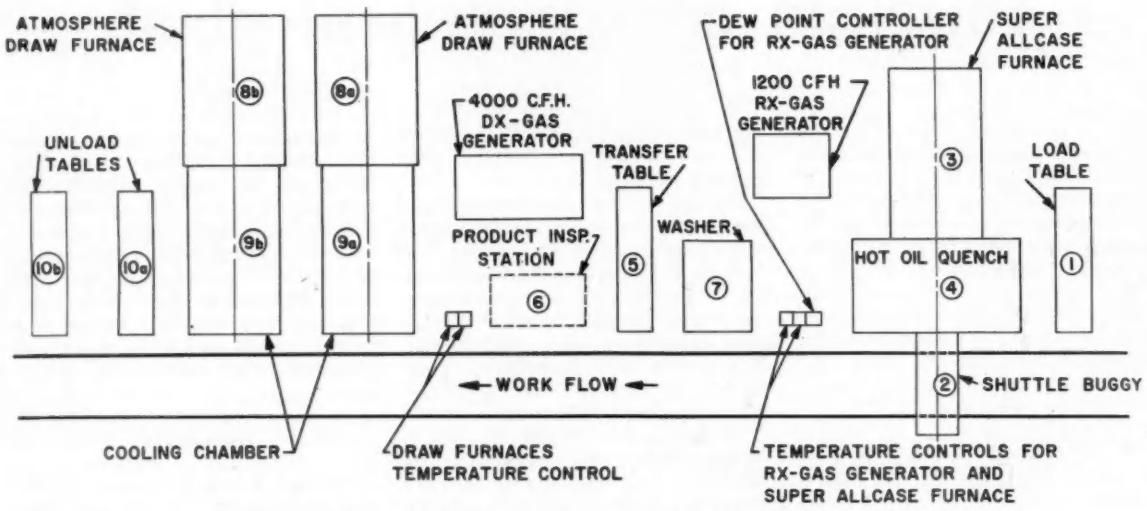
The vestibule used for charging and discharging the furnace is provided with an overhead cooling chamber. This feature permits loading the furnace with fresh work while the previously tempered load is being further cooled in the same atmosphere as used in the furnace. Most of the work is tempered in a 1,050°-1,200°F. range. Use of a DX gas atmosphere generator not only eliminates scaling at these temperatures, but produces an acceptable surface finish without the need of expensive blasting operations. Handling is cut to a minimum, and possible sources of nicking heavy and expensive parts is reduced.

One man operates all the heat treating facilities in this particular straight line arrangement. This is accomplished primarily by means of a shuttle-bogey, which the operator actually rides. The bogey runs on two floor rails installed over the full length of the heat treating line.

Automatic operation

The trays are loaded at a work station by the operator, and automatically moved on the shuttle-bogey as required. The operator, riding the running board of the loaded bogey, conveys the load to the Super Allcase furnace. The furnace door is opened, and a transfer chain on the bogey charges the tray load of parts into the furnace vestibule, and the door closes. From this point on, the operation, which consists of transfer to heating chamber, temperature, time at temperature, removal for quench, and positioning for removal from the furnace itself, is automatic.

At this point the transfer chain removes the load from the furnace and places it on the shuttle-bogey to be transported to the spray washer. After removal of excess quenching oil, the trays are moved to a holding rack. Here the parts are permitted to cool



Sequence of straight-line heat treatment at Harnischfeger Corporation.

1. Tray on load table loaded by operator.
2. Shuttle bogey picks up load and deposits it in Super Allcase furnace.
3. Load heated to hardening temperature.
4. Load automatically quenched in hot oil.
5. Shuttle bogey moves load to transfer table.
6. Product inspection station.
7. Load washed.

8A or B. Load tempered in one of atmosphere draw furnaces.

9A or B. Load cooled in cooling chamber.

10A or B. Unload tables.

further for completion of metallurgical transformation, and to permit surface inspection and 'as quenched' hardness checks. Several types of hardness testing equipment are incorporated in the line at this point.

After such checks the trays are again 'chain transferred' to the shuttle-bogey, transported to one of the two Surface tempering furnaces, conveyed into the vestibule and again automatically processed through the tempering cycle. After tempering, the tray load of parts is automatically transferred to an overhead cooling chamber in the furnace where it is cooled below excessive scaling temperature.

Complete inspection

The loaded trays are again transferred to the shuttle-bogey and moved to the unloading station. Complete inspection is now made on the heat treated parts and they are then passed out to assembly or for final machining operations.

With this straight line arrangement wasted motion, unnecessary handling, confusion and lost time have been minimized by the streamlining of the operation. Mechanical handling methods, automatic controls, and fully-protected safety equipment permit complete operation with further economy because of the single operator required.

A higher quality product is also obtained, the use of atmosphere controlled equipment readily permitting heat treating finished or semi-finished parts to impart mechanical properties where they are most needed.

Boiler provides process heat as well as hot water for personnel

TWO services for little more than the price of one. This was the thought in their minds when the Walter Kidde Co. Ltd., of Northolt recently extended their premises and required supplementary heating in the paint spray shop as well as hot water for the toilets.

The problem was solved by the installation of a Kayenco gas fired boiler, the work being undertaken by their own heating contractors, Burgess & Co. (Engineers) Ltd., of Bracknell, Berks. This compact boiler, with a rated output of 151,000 B.t.u. per hour, occupies the minimum of factory space.

With clock control to switch on and off at predetermined times, and a thermostat to maintain a constant water temperature, the boiler is economical in use and sufficiently flexible in operation to meet all demands made upon it.

Two coppered unit air heaters in the spray shop maintain the correct working temperature during the milder winter periods when the main boiler plant is not in use.

In addition, hot water for some 60 works personnel is provided at a central washing fountain by a calorifier system.

The installation was carried out in conjunction with the North Thames Gas Board.

THE GAPMETERS

These are variable-area direct-reading flowmeters for liquids and gases. They are simple instruments: accurate, compact and inexpensive.

Gapmeters are adaptable and easy to install in either vertical or horizontal piping (at any angle). Interchangeable fittings allow Front or Back Panel pipe connections; also attachment to Slotted Angle Frames and Laboratory Scaffolding.

Gapmeters, made for ⅛", ¼" and ⅜" B.S.P. sizes (with Nozzle, Straight Union or Banjo fittings), fulfill the need for small, precision-made, flowmeters at low cost for use with Service Fluids, Fuels and Scavenging Fluids, Inert Gases and Cooling Fluids as well as general chemical and process operations.

Floats and other contact components are readily made in materials to suit all industrial fluids. All floats rotate. Bold scales are used, and each instrument is protected by a perspex cover.

G. A. PLATON LTD. *Makers of the Flostat*

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KNOW YOUR KITCHEN EQUIPMENT

3.—Deep fat frying pans and frying ranges

By GASTRONOME

THE purpose of this series of articles is to focus attention on the appliances that can with advantage replace existing inefficient equipment. The writer needs no reminder that age alone is not necessarily detrimental to the efficiency, or even the economy, of the equipment in the staff restaurant kitchen.

It would be of little value to recommend any replacement that would not bring about marked improvements of one kind or another, whether it be cooking performance, speed of cooking or the cost of the fuel needed to do the cooking. It is, therefore, with every confidence that the modern deep fat fryer is spotlighted for attention, as it is most likely to displace a very large number of appliances that, in survey, are proving to be sluggish, comparatively expensive to operate and, moreover, require constant supervision during cooking.

All these points amount to prolonged cooking, which means with many foods a spoilt product and unappetising appearance and taste, costliness in fuel and waste in cooking media, with a considerable amount of the cook's time being taken up for a much longer period than is really necessary.

Convincing picture

A new era in design of fryers has given to the gas industry a first-rate appliance, a model that even now is being redesigned to give even better all round results. Comparison with an appliance of pre-war, or even immediate post-war vintage, would probably reveal a convincing picture.

Practically all these had completely flat base pans—true, some of them had reasonably good heat exchangers by the use of studs or pins on the outside of the pan, but as a whole they were sluggish in performance, and cooking times of up to 15 minutes, in addition to recovering the temperature of the cooking oil, were quite commonplace. Those pans that incorporated thermostatic control relied upon this alone, and, as such, response to the variations of temperature were slow.

Laboratory tests on food and fuel relationship gave peak figures of 2,000 B.t.u. plus to cook 1 lb. of raw potatoes. Taken all round, the pans were as good as anything competitive at the time, but development was long overdue; although a measure of fresh and inspired design had taken place, it had not in fact been taken up by the manufacturers of this class of equipment.

The years immediately after the war were ripe for development, but it was slow, due to full production of meals. Even so it did start, and today there is an excellent array of first-class deep fat fryers on the market. Chief among these manufacturers are: Adam & Sons with their several models, of which the Starfish has a very high marking; Benham & Sons with their deep fat unit fryer, since redeveloped with a finned base; R. & A. Main with their very handy little 91F fryer with the hygienic vitreous enamel pan; James Stott & Son Ltd. with the large Autofry and the equally effective deep fat model; Oliver Tom's Ltd. with their very successful Frymaster; Metal Containers Ltd., of Edinburgh, with their Meta fryer; Bartlett's and Aquafont Industries Ltd., with their equally efficient pans.

An interesting development of redesigning in post-war years has been carried out by Modern Metals Ltd., who have produced three deep fat fryers in succession, each improving upon the other.

In general, most manufacturers today have reasonably designed pans, most of which have passed British Standards 2512, and figures in the neighbourhood of 1,000 B.t.u., are almost imminent to cook 1 lb. of raw potatoes. Indeed, 1,200 B.t.u. have already been passed. This, of course, only refers to the fuel efficiency of the appliance—what is important is the *speed* of cooking. Fryers that before the war were producing, for example, 30 lb. of chips per hour have, with the same redesigned pans, reached over double those figures.

When you consider that the up-to-date fryer can save 50% in cooking oil, 50% in fuel consumption and is completely automatic in temperature control, then to put up with an out-of-date sluggish pan that requires manual supervision is indeed inefficient, and should be corrected without delay. It is bound to pay dividends; the savings on these three points alone could pay for a fryer within three months and that, these days, is really something.

New Powell Duffryn company formed, takes over Dravo sales

A NEW company in the Powell Duffryn group has been formed and will market the Dravo industrial space heater, formerly handled for five years by Weatherfoil Ltd.

The new company will be known as Powell Duffryn Modulair Ltd. and will have its offices at Powell Duffryn House, Berkeley Street, London, W.1. Its principal function will be the marketing of all types of heating, ventilation and air distribution equipment. The Dravo heater is manufactured in the U.K. by Coventry Radiator & Presswork Co. Ltd., under licence from the Dravo Corporation, the American engineering concern.

Powell Duffryn Modulair Ltd. is also taking over from Weatherfoil Ltd. the marketing of Tuttle & Bailey equipment both in the U.K. and in many overseas countries. Although Tuttle & Bailey air distribution equipment has not previously been generally available in the U.K., many famous buildings in the United States, such as the Air Force Academy at Colorado Springs, the Pan American building at Idlewild, the Senate Office building in Washington and the Beverley Hilton Hotel, Los Angeles, incorporate the equipment.

The Chairman of the new company is Mr. W. H. Sharland and it will be managed by Mr. E. B. Overton. Mr. Sharland is Deputy Chairman of the parent company, Powell Duffryn, Ltd., and Mr. Overton was formerly a director of Weatherfoil Ltd., from which company he has resigned. He is also a director of Janitor Boilers Ltd.—another Powell Duffryn Group company. Mr. Barrie Heath, Managing Director of Powell Duffryn Carbon Products Ltd., and Mr. R. H. Stewart, Managing Director of Janitor Boilers, are also on the Board.